FASTENER INSTALLING DEVICE AND FASTENER MEMBER

Field of the Invention

The present invention relates to a fastener installing device used for installing a strip-shaped fastener member in a rail-shaped holding part. The present invention also relates to a fastener member capable of being installed using such a fastener installing device.

Background

In an article such as a vehicle seat, an office or domestic chair or a mattress, consisting of a cushioning core made, for example, of expansion-molded resin and a soft cover such as cloth or leather for covering a surface of the core, the use of a fastener of a face-to-face engagement type (a so-called surface fastener) has been known for firmly attaching the cover onto the core, which fastener has a plurality of engaging elements on one surface (a major surface) of a base. For example, see Japanese Unexamined Patent Publication (Kokai) No. 9-224720.

Since a car seat or a chair is particularly required to provide a high level of comfort to the user, an elongate strip-shaped fastener member capable of being located in a groove provided on a surface of the core along a seam line or the like of the cover is often used as means for attaching the cover to the core. To fixedly mount such a strip-shaped fastener member to a desired position on the surface of the core so that the plurality of engaging elements are exposed to outside, an insert molding method is advantageously adopted, wherein the fastener member is located as an insert within a mold cavity for the core which is a molded main body so that the fastener member is fixed to the core simultaneously with the molding of the core.

According to this insert molding method, a rail-shaped holding part is provided in advance within the mold cavity for the molded main body, for holding the fastener member in a predetermined posture. The holding part is formed in general as a rail-shaped block body having a receptive groove capable of accommodating the base of and the plurality of engaging elements of the fastener member. The fastener member is installed in the holding part while inserting the engaging elements and the base into the receptive groove of the holding part and exposing a back surface of the base (a surface

opposite to the major surface) to outside. In this regard, in the interior of the mold cavity for the molded main body, the holding parts are provided, which number corresponds to that of the fastener members to be mounted to the molded main body. When the fastener members are mounted to various three-dimensional surface areas of the molded main body, the holding parts having receptive grooves of various three-dimensionally curved profiles are provided.

In the prior art, when the fastener member is installed in the holding part of this kind, one longitudinal end of the base of the fastener member is substantially positioned to one longitudinal end of the holding part, and thereafter, the engaging elements and the base are gradually pushed into the receptive groove from this positioned end toward the other longitudinal end by a manual operation of the operator. Usually, the receptive groove of the holding part has a dimension capable of frictionally holding the base at a proper position to prevent the fastener member from shifting due to the flow of molten material and to avoid the molten material from invading the major surface of the base of the fastener member. Accordingly, when the fastener member is pushed into the receptive groove of the holding part, the operator uses in general a pallet-like pressing tool or a pressing roller to gradually apply a necessary pressure to the back surface of the base in the longitudinal direction, whereby the fastener member is properly installed in the holding part.

When a plurality of fastener members must be mounted to the molded main body in the prior art method for installing the fastener member in the holding part by a manual operation as described above, the fastener members must be sequentially installed in a plurality of holding parts one by one. Consequently, much time is required for the installation of the fastener members, whereby there is a risk of impediment of the improvement in the productivity of the molded main body with fasteners. Further, when the fastener members are installed in the holder parts of various three-dimensionally curved profiles, the operator is required to bend a wrist in various directions as a pressure is gradually applied to the base of the fastener member, whereby there is a risk of fatigue of the operator. In addition, to quickly and properly install the fastener members in the holding parts having such three-dimensionally curved profiles, skill is required in the operation.

Accordingly, there is a need for a fastener installing device that does not exhibit

one or more of the above described problems and/or shortcomings.

Summary of the Invention

This need can be satisfied by providing a fastener installing device according to the present invention. The present device is used for installing, in advance, a strip-shaped fastener member to be attached to a molded main body by an insert molding process in a rail-shaped holder part located within a mold cavity for the molded main body. The present device can reduce the time required for the installation of the fastener member even when a plurality of fastener members must be attached to the molded main body to improve the productivity of the molded main body with fasteners. The present device can also quickly and properly install the fastener members even in the holding parts having various three-dimensionally curved profiles with no skill for the operation while mitigating a fatigue of the operator.

This need can also be satisfied by providing a fastener member capable of conveniently using the above-mentioned fastener installing device and further facilitating the workability of the installation.

In one aspect of the present invention, a fastener installing device is provided that is used for installing a fastener member including a strip-shaped base and engaging elements provided on a major surface of the base in a rail-shaped holding part having a receptive groove capable of accommodating the base and the engaging elements. The fastener installing device comprises a body; and a plurality of attaching sections capable of being individually engaged with the plurality of fastener members, respectively; the attaching sections acting to substantially simultaneously push the respective bases and engaging elements of the fastener members into the receptive grooves of the corresponding holding parts, when the body is transferred, while keeping the attaching sections individually engaged with respective fastener members.

It can be desirable for at least one of the attaching sections of the present fastener installing device to be shiftable on the body. Such an attaching section shiftable on the body can also be made to perform a parallel motion in a predetermined direction on the body. Attaching sections that are shiftable on the body can also be made to perform a pivoting motion about a predetermined axis on the body, instead of or in addition to performing the parallel motion in a predetermined direction on the body. It

can also be desirable for the present fastener installing device to include an elastic member located between the body and the attaching section, that is shiftable on the body, to bias the attaching section toward an initial position on the body.

In another aspect of the present invention a fastener member is provided that includes a strip-shaped base and engaging elements provided on a major surface of the base. A protrusion uprightly projects from the major surface in a substantially identical direction to the engaging elements. This protrusion is formed at one longitudinal end of the base. Instead of or in addition to this protrusion, the present fastener member can include an extension extending from a back surface opposite to the major surface in a hooked and bent manner. This extension is formed at one longitudinal end of the base.

Brief Description of the Drawings

Fig. 1 is a perspective view of a fastener installing device according to one embodiment of the present invention, as seen from above.

Fig. 2 is a perspective view of the fastener installing device shown in Fig. 1, as seen from beneath.

Fig. 3 is a partially cutoff perspective view of a fastener member and a holding part to which the fastener installing device shown in Fig. 1 is applicable.

Fig. 4 is an enlarged perspective view of a first attaching section of the fastener installing device shown in Fig. 1.

Fig. 5 is an enlarged perspective view of a second attaching section of the fastener installing device shown in Fig. 1.

Fig. 6 is a sectional view of the fastener member and the holding part installed by using the fastener installing device shown in Fig. 1.

Fig. 7 is a perspective view schematically showing one aspect of the installing operation by means of the fastener installing device shown in Fig. 1.

Fig. 8 is a partially sectional front view schematically showing the movement of the respective attaching sections of the fastener installing device in the installing operation shown in Fig. 7, wherein (a) is a stage in which all the holding parts are linear portions, and (b) is a stage in which one of the holder parts is a slope portion.

Fig. 9 is a plan view schematically showing the movement of the respective

attaching sections of the fastener installing device in the installing operation shown in Fig. 7, wherein (a) is a stage in which all the holding parts are linear portions, and (b) is a stage in which one of the holder parts is a curved portion.

Fig. 10 is a partially sectional front view of a fastener installing device according to another embodiment of the present invention shown together with a plurality of holding parts and fastener members.

Fig. 11 is a partially enlarged perspective view of a fastener member according to one embodiment of the present invention to which the fastener installing device according to the present invention is preferably applicable.

Fig. 12 is a partially enlarged perspective view of a fastener member according to another embodiment of the present invention to which the fastener installing device according to the present invention is preferably applicable.

Fig. 13 is a view of a modification of an attaching section of a fastener installing device capable of using the fastener member shown in Fig. 12.

Detailed Description

Modes for carrying out the present invention will be described in detail below with reference to the attached drawings, wherein the same or similar components are denoted by common reference numerals. Although the present invention is herein described in terms of specific embodiments, it will be readily apparent to those skilled in this art that various modifications, re-arrangements, and substitutions can be made without departing from the spirit of the invention. The scope of the present invention is thus only limited by the claims appended hereto.

Fig. 1 is a perspective view of a fastener installing device 10 according to one embodiment of the present invention as viewed from above; Fig. 2 is a perspective view of the fastener member as viewed from below; and Fig. 3 is a perspective view of a fastener member 12 and a holding part 14 to which the fastener installing device 10 is applicable. The fastener member 12 is a face-to-face engagement type fastener member having the flexibility conformable with various three-dimensional surfaces of a molded main body (not shown) such as a core of a seat or a chair and, as described later, has a strip-shaped base 16 and a plurality of engaging elements 20 uprightly projecting from a major surface 18 of the base 16. The holding part 14 is a rail-shaped block body for

holding the fastener member 12 at a predetermined posture in advance within a mold for a molded main body (not shown), and has a receptive groove 22 capable accommodating the base 16 and the plurality of engaging elements 20 of the fastener member 12 as described later.

The fastener installing device 10 is provided with a body 24 operable by being held by hands and three attaching sections 26 and 28. The body 24 is provided with a support frame 30 having a rigidity not easily deformed by an external force and a pair of grips 32 fixedly arranged on an upper surface 30a of the support frame 30. The support frame 30 is a plate-like member of a leftward/rightward symmetrical shape in relation to a center line 34 wherein the pair of grips 32 are provided at positions line-symmetrical with each other in relation to the center line 34 on the support frame 30. Thus, the operator can manually operate the body 24 while holding the grips 32 by left and right hands to relatively easily apply a uniform force to the entirety of the support frame 30.

The three attaching sections 26 and 28 to be provided in the body 24 are constituted by a first attaching section 26 provided on a lower surface 30b of the support frame 30 at a position along the center line 34, and a pair of second attaching sections 28, each provided on the lower surface 30b at a position beneath each of the pair of grips 32. These attaching sections 26 and 28 are individually engaged with a plurality of fastener members 12 during the installation of the fastener members described later so that the base 16 and the engaging elements 20 of the respective fastener member 12 are pushed into the corresponding receptive groove 22 of the holding section 14. In this regard, in the illustrated embodiment, the support frame 30 has a structure wherein a plate-like central portion for supporting of the first attaching section 26 and two plate-like wing portions for supporting the second attaching sections 28, respectively, are coupled to each other, for example, by bolts or others not shown via a difference in level. Accordingly, the upper surface 30a and the lower surface 30b of the support frame 30 are formed as a stepped surface.

The first and second attaching sections 26, 28 are respectively shiftable on the support frame 30 of the body 24.

Specifically, the first attaching section 26 is provided with a plate-like attachment piece 36 of a generally rectangular shape and a pair of guide shafts 38

uprightly extending parallel to each other from an upper surface 36a of the attachment piece 36. These guide shafts 38 are received into a pair of slide bearings 40 bored through the support frame 30 of the body 24, respectively, to be slidable in the axial direction (see Fig. 4). In this state, the upper surface 36a and the lower surface 36b of the attachment piece 36 are disposed generally parallel to the lower surface 30b of the support frame 30. In such a manner, the attachment piece 36 supported by the support frame 30 via the guide shafts 38 and the slide bearings 40 is movable in the direction substantially vertical to the lower surface 30b of the support frame 30 while maintaining a parallel state.

An elastic member 42 is provided between the support frame 30 of the body 24 and the attachment piece 36 of the first attaching section 26, for biasing the attachment piece 36 toward an initial position on the support frame 30. The elastic member 42 is a compressive coil spring located at a position between the pair of guide shafts 38 disposed along the center line 34 and applying an elastic bias generally to a center of the upper surface 36a of the attachment piece 36 to cause the attachment piece 36 to be away from the support frame 30. Each of the pair of guide shafts 38 is provided with a flat-head section 38a annularly expanding in the radial direction at a tip end thereof projecting upward from the upper surface 30a of the support frame 30. The flat-head section 38a of the respective guide shaft 38 is capable of being in contact with the upper surface 30a of the support frame 30 under the bias of the elastic member 42, and in this state, the attachment piece 36 is held at a position farthest from the support frame 30 (i.e., the initial position).

According to such an arrangement, the elastic member 42 provided in the first attaching section 26 yields to a pressure applied to the fastener member 12 by the operator via the fastener installing device 10 during the installation of the fastener member described later to load the fastener member 12 with the elastic bias substantially in the same direction as that of the pressure applied by the operator. In this regard, the elastic member 42 may be formed of other elastic material such as a blade spring or rubber.

A pair of pressers 44 extend generally in parallel to each other on the lower surface 36b of the attachment piece 36 of the first attaching section 26 generally at a center thereof. These pressers 44 operate to be simultaneously brought at front edges

thereof into contact with a back surface 90 of the base 16 of the fastener member 12 (Fig. 3) during the installation of the fastener member described later so that the bias of the elastic member 42 generated due to the pressure applied by the operator is concentrically loaded to the base 16. Also, the pair of pressers 44 operate to be brought into contact with inner surfaces 110a of opposite side walls 110 defining the receptive groove 22 of the holding part 14 (Fig. 3) to which the first attaching section 26 is applied during the installation of the fastener member described later so that the first attaching section 26 and the body 24 are guided along the holding part 14.

As illustrated, the attachment piece 36 may have cylindrical guide members 46 projecting upright at four corners of the lower surface 36b thereof, each having an axis generally vertical to the lower surface 36b. These guide members 46 operate to be suitably brought into contact with outer surface of the opposite side walls 110 defining the receptive groove 22 of the holding part 14 to which the first attaching section 26 is applied during the installation of the fastener member described later so that the first attaching section 26 and the body 24 are additionally guided along the holding part 14.

Each of the pair of second attaching sections 28 is provided with a plate-like attachment piece 48 of a generally rectangular shape and a slide carriage 50 disposed adjacent to an upper surface 48a of the attachment piece 48. The attachment piece 48 and the slide carriage 50 are couple in a rotatable manner with each other via a shaft 52 and a bearing (not shown). A linear guide 54 is fixed to the slide carriage 50 so that the linear guide 54 is linearly movable along a guide rail 56 fixed to the lower surface 30b of the respective wing portion of the support frame 30 (see Fig. 5). In this state, the upper surface 48a and the lower surface 48b of the attachment piece 48 are arranged generally in parallel to the lower surface 30b of the support frame 30. In such a manner, the attachment piece 48 supported on the support frame 30 via the slide carriage 50, the linear guide 54 and the guide rail 56 is linearly movable in the direction substantially parallel to the lower surface 30b of the support frame 30 as well as rotatable about an axis 58 substantially vertical to the lower surface 30b.

The pair of guide rails 56 fixed onto both the wing portions of the support frame 30 of te body 24 linearly extend in the directions to make an obtuse angle each other and are arranged to incline in relation to the moving direction of the body 24 along the plurality of holding parts 14 during the installation of the fastener member described

later. Poles 60 are provided respectively at one ends of these guide rails 56 closer to each other.

An elastic member 62 is provided between the support frame 30 of the body 24 and each of the attachment pieces 48 of the second attaching sections 28, for biasing the attachment piece 48 toward the initial position thereof on the support frame 30. The respective elastic member 62 is a stretching coil spring, one end of which is hooked to the pole 60 of the guide rail 56 and the other end is hooked to a pole 64 uprightly provided on the upper surface 48a of the respective attachment piece 48 to elastically bias the attachment piece 48 in the direction approaching the pole 60 of guide rail 56. On the lower surface 30b of the support frame 30, a stopper 66 capable of being brought into contact with the linear guide 54 of the respective second attaching section 28 is fixedly provided adjacent to the respective guide rail 56. The respective linear guide 54 is brought into contact with the stopper 66 under the bias of the elastic member 62, and at this point, the attachment piece 48 of the respective second attaching section 28 is held at a position closest to the pole 60 of the respective guide rail 56 (i.e., the initial position; Fig. 1). Further, the respective elastic member 62 elastically biases the respective attachment piece 48 to a position at which the pole 60 and the pole 64 are closest to each other (i.e., the initial position).

According to such an arrangement, the elastic member 62 provided in the respective attaching section 28 operates to locate the first and second attaching sections 26, 28 in advance during the installation of the fastener member described later at positions corresponding to relative positions of distal ends of the plurality of holding parts 14, which are the starting points of the installing operation. In this regard, the elastic member 62 may be formed of other elastic material such as a blade spring or rubber. Also, at ends of both the guide rails 56 opposite to each other, second stoppers 68 are fixedly provided for preventing the linear guides 54 from coming off.

In the attachment piece 48 of the respective second attaching section 28, a pair of pressers 70 extending parallel to each other are provided in a generally central region of the lower surface 48b thereof. These pressers 70 are simultaneously brought at distal ends thereof into contact with the back surface 90 of the base 16 of the fastener member 12 (Fig. 3) during the installation of the fastener member to concentrically load the base 16 with the pressure applied to the body 24 by the operator. Also, the pair of

pressers 70 operate to be brought into contact with the inner surface 110a of the opposite side walls 110 defining the receptive groove 22 of the holding part 14 to which the respective second attaching section 28 (Fig. 3) is applied during the installation of the fastener member described later and guiding the respective second attaching section along the holding part 14.

In the attachment piece 48, cylindrical guide members 72, each having an axis generally vertical to the lower surface 48b, may be provided at four corners of the lower surface 48b thereof as illustrated. These guide members 72 operate during the installation of the fastener member described later to be suitably brought into contact with the outer surface of the opposite side walls 110 defining the receptive groove 22 of the holding part 14 to which the respective second attaching section 28 is applied and additionally guide the respective second attaching section 28 along the holding part 14. In this regard, the respective guide member 72 may be formed as a roller rotatable about an axis for further facilitating the guiding operation.

Next, the arrangement of the fastener member 12 and the holding part 14 to which the fastener member installing device 10 is applicable will be described in more detail with reference to Figs. 3 and 6.

The fastener member 12 is provided with a plurality of box-shaped sections 80 spaced from each other in the longitudinal direction and a plurality of joint sections 82 for coupling the box-shaped sections 80 in integral with each other. The respective box-shaped section 80 has an upper plate part 84 and a lower plate part 86 extending generally in parallel to each other, and a pair of side plate parts 88 connecting them with each other. The upper plate parts 84 of the plurality of box-shaped sections 80 constitute the major surface 18 of the base 16 carrying a plurality of engaging elements 20 thereon, while the lower plate parts 86 of the plurality of box-shaped sections 80 constitute the back surface 90 of the base 16 together with the plurality of joint sections 82. A vertical plate part 92 is provided in the respective box-shaped section 80 between the upper plate part 84 and the lower plate part 86 and between both the side plate parts 88, so that a pair of spaces 94 are defined within the respective box-shaped section 80 by these plate parts 84, 86, 88 and 92.

Each of the plurality of engaging elements 20 is provided with a stem 96 projecting upright from the upper plate part 84 of the respective box-shaped section 80

and a plurality of barbs 98 laterally protruding from a region of the stem 96 in the vicinity of a distal end thereof. Accordingly, in the fastener member 12, the plurality of engaging elements 20 are engaged with the corresponding engaging elements of the mating fastener member by the barbs 98 of the distal ends of the respective engaging elements. In this regard, the box-shaped sections 80' positioned at the longitudinal opposite ends of the base 16 have no engaging elements 20.

In the lower plate part 86 of the respective box-shaped section 80, a slit 100 extending in the transverse direction is formed generally at a longitudinal center thereof. Further, in the lower plate part 86, a rib 102 extending in the longitudinal direction while crossing the slit 100 is formed on the back surface 90 all over the base 16. On the rib 102, two thin plate-like anchors 104 extending generally in parallel to the lower plate part 86 are formed in correspondence to the respective box-shaped section 80. The rib 102 and the anchors 104 are joint elements embedded in the molded main body by an insert molding process described later and constitute a mechanical joint part.

According to the fastener member 12 of such a structure, the base 16 can be relatively easily bend as a whole in the horizontal direction, i.e., the direction parallel to the major surface 18 due to the stress-dispersing operation of the spaces 94 of the respective box-shaped section. Also, due to the hinge action of the respective thin-walled joint section 82, the base 16 can be relatively easily bend as a whole in the vertical direction, i.e., the direction transverse to the major surface 18. Since the base 16 can be bend either in the horizontal direction or in the vertical direction in such a manner, the fastener member 12 can be located on a desired surface area of an article having various three-dimensional surfaces while accurately three-dimensionally conforming the base 16 therewith. In this regard, the fastener member 12 is preferably formed of resinous material such as polyamide, polyester or polypropylene, as a one-piece body.

The holding part 14 is a rod-like block for holding the fastener member 12 over a desired length, and is provided with a pair of side walls 110 and a bottom wall 112 defining a linearly receptive groove 22 capable of accommodating the base and the plurality of engaging elements 20 of the fastener member 12. The pair of side walls 110 are spaced in parallel to each other with the bottom wall 112 interposed between the both, so that inner surfaces 110a are formed opposite to each other at a uniform

interval over a total length of the holding part 14. The bottom wall 112 is provided with a pair of sealed parts 114 formed between both the side walls 110 at opposite longitudinal end areas of the receptive groove 22, and a pair of auxiliary supporting parts 116 extending in the longitudinal direction of the holding part 14 adjacent to the respective side walls 110. A recess 118 constituting part of the receptive groove 22 is defined between the sealed parts 114 and between the auxiliary supporting parts.

The interval between the inner walls 110a of the pair of side walls 110 is generally equal to the transverse-directional dimension of the base 16 of the fastener member 12 to be supported. Accordingly, the inner wall 110 of the respective wall 110 is brought into close contact with a lateral edge, extending in the longitudinal direction, of the base 16 of the fastener member 12 received in the receptive groove 22. In the recess 118 constituting part of the receptive groove 22, the plurality of engaging elements 20 of the fastener member 12 are accommodated. The bottom wall 112 is brought into close contact with part of the major surface 18 of the base 16 of the fastener member 12 received in the receptive groove 22 by top surfaces of the sealed parts 114 and the auxiliary supporting parts 116. The fastener member 12 is maintained at a predetermined posture by the frictional force generated due to the engagement of the base 16 into the receptive groove 22 of the holding part 14. Also, the molten material for the molded main body is prevented from invading the recess 118 when the main body is molded while supporting the fastener member 12 in the holding part 14. In this regard, the holding part 14 may be manufactured as a one-piece body by cutting a rod-like material, for example, of aluminum, aluminum alloy, steel or resin.

Next, the process for installing fastener members 12 in a plurality of holding parts 14 by means of the fastener installing device 10 will be described with reference to Figs. 7 to 9.

As one example, three holding parts 14 having various bending configurations as shown in Fig. 7 are fixed in a predetermined arrangement on a reference surface R defining a mold surface of a mold for the main body to be molded with securing means such as putty, bolt or magnet while directing the receptive grooves 22 thereof upward. In the illustrated example, the holding part 14 disposed at a center has a linear portion 14a straightly extending along a planar region of the reference surface R and a sloped portion 14b bendingly extending in the vertical direction along a bulged region of the

reference surface R present midway of the linear portion 14a. On the other hand, each of a pair of holding parts 14 disposed on opposite side has a linear portion 14a and a curved portion 14c bendingly extending in the horizontal direction along a planar region of the reference surface R at a distal end of the linear portion 14a. The linear portions 14a of these holding parts 14 are arranged generally in parallel to each other.

Next, as a preparatory operation, the operator opposes the major surfaces 19 of the respective bases 16 of the three fastener members 12 to the receptive grooves 22 of the respective holding parts 14 by a manual operation so that one longitudinal end of the respective base 16 substantially positioned to one longitudinal end of the respective holding part 14, and, thereafter, pushes one end regions of the bases 16 (one or two of box-shaped sections 80', 80) and the groups of engaging elements 20 corresponding thereto into the respective receptive grooves 22 to temporarily fix the same. In this state, the first attaching section 26 of the fastener installing device 10 is brought into contact with the end region wherein the central holding part 14 and the fastener member 12 are temporarily fixed to each other, and both the second attaching sections 28 are brought into contact with both the end regions wherein the opposite side holding parts 14 and the fastener members 12 are temporarily fixed to each other. Thus, the fastener installing device 10 is located at a starting position of the installing operation.

At the starting position of the installing operation, the pairs of pressers 44, 70 provided in the attachment pieces 26, 28 of the fastener installing device 10 are located adjacent to the inner surfaces 110a of the opposite side walls 110 in the end region of the respective holding part 14 and pressed onto the back surface 90 of the base 16 of the respective fastener member 12 temporarily fixed to the end region of the respective holding part 14. At the same time, the four guide members 46, 72 of the attaching sections 26, 28 are located adjacent to the outer surfaces of the opposite side walls 110 in the end region of the respective holding part 14 (see Figs. 8 and 9). At this time, it is possible to easily and quickly locate the fastener installing device 10 at the starting position of the installing operation by preliminarily adjusting the initial position of both the second attaching sections 28 on the body 24 of the fastener installing device 10 to arrange the relative positions of the first and second attaching sections 26, 28 in correspondence to the relative positional relationship between the end regions of the three holding parts 14 defining the starting points of the installing operation. In this

regard, the adjustment of the initial position of the respective second attaching section 28 can be carried out, for example, by properly changing the position of the stopper 66 provided in the respective guide rail 56 of the support frame 30.

In this regard, the pairs of pressers 44, 70 and the four guide members 46, 72 provided in the attachment pieces 36, 48 of the attaching sections 26, 28 are located in advance at proper positions on the attachment pieces 36, 48 in correspondence to the interval between the opposite side walls 110 of the respective holding part 14 to which the attaching section 26, 28 is applied.

When the operator moves the fastener installing device 10 in one direction (in the arrowed direction A in Fig. 7) while holding the grips 32 by both hands to apply a force to the body 24 so that the first and second attaching sections 26, 28 are uniformly pressed onto the three holding parts 14, the groups of engaging elements 20 and the bases 16 of the three fastener members 12 are gradually pushed into the receptive grooves 22 of the corresponding holding parts 14 from the temporarily fixed end regions to the other longitudinal ends substantially at the same time. Upon reaching the longitudinal ends of the holding parts 14, the fastener installing device 10 completes the installation of the fastener members 12, and as a result, the fastener members 12 are installed in the three holding sections, respectively, substantially at the same time.

While the fastener installing device 10 moves in one direction along the three holding parts 14, the pressers 44, 70 of the respective attaching sections 26, 28 are continuously brought into slide contact with the back surfaces 90 of the bases 16 of the respective fastener members 12 to concentrically load the corresponding bases 16 with the pressure applied by the operator to the body 24 (the second attaching section 28) or the bias of the elastic member 42 (the first attaching section 26). Accordingly, even if a non-installed portion of the respective fastener member 12 largely deviates from the respective holding part 14, for example, as shown in Fig. 7, the base 16 can be assuredly gradually pushed into the receptive groove 22 of the holding part 14 due to its inherent elastic recovery force. Simultaneously therewith, the pressers 44, 70 of the respective attaching sections 26, 28 are properly brought into slide contact with the inner surfaces 110a of the opposite side walls 110 of the respective holding part 14 to guide the attaching sections 26, 28 along variously curved profiles of the holding parts 14.

While the three fastener members 12 are simultaneously pushed into the linear portion 14a of the corresponding holding part 14 from the starting position of the installing operation (the upper shifting area in Fig. 7), the operator linearly moves the fastener installing device 10 along the linear portion 14a in the arrowed direction A. This moving operation is linearly guided by the mutual contact between the pair of pressers 44 of the first attaching section 26 which is not movable on the body 24 in the horizontal direction and the opposite side walls 110 of the central holding part 14 corresponding thereto. During this operation, the four guide members 46 of the first attaching section 26 also additionally operate to linearly guide the fastener installing device 10.

In the meanwhile, as shown in Fig. 8(a), both the second attaching sections 28 of the fastener installing device 10 load the bases 16 of the corresponding fastener members 12 with the pressure applied by the operator to the body 24 via the pressers 70 of the respective attachment pieces 48. Also, the first attaching section 26 occupies a position where the elastic member 42 is slightly compressed, and load the base 16 of the corresponding fastener member 12 with the bias due to the elastic member 42 via the pressers 44 of the attachment piece 36. Further, as shown in Fig. 9(a), both the attachment pieces 36, 48 of the first and second attaching sections 26, 28 are directed mutually in the same direction by the guiding action of the pressers 44, 70 and the guide members 46, 72 thereof. Also, since the relative positional relationship between the three holding parts 14 is not changed from the starting position of the installing operation, the attachment pieces 48 of the respective second attaching sections 28 are disposed at the initial position on the respective guide rails 56.

While the fastener installing device 10 enters the central slope portion 14b from this state and pushes the three fastener members 12 into the slope portion 14b and linear portions 14a of the opposite side holding parts 14a at the same time (the intermediate shifting area in Fig. 7), the operator moves the fastener installing device 10 in the arrowed direction A along the linear portion 14a, as before. This moving operation is linearly guided by the mutual contact between pressers 44 of the first attaching section 26 and the opposite side walls 110 of the central holding part 14, in the same manner as in the upper shifting area described before.

In the meanwhile, the operator applies a sufficient pressure to the body 24 of the

fastener installing device 10 so that the pressers 70 of both the second attaching sections 28 are continuously brought into contact with the bases 16 of the corresponding fastener members 12 under pressure, as shown in Fig. 8(b). Thereby, the first attaching section 26 loads the base 16 of the corresponding fastener member 12 with the bias due to the elastic member 42. Thereby, the first attaching section 26 loads the base 16 of the corresponding fastener member 12 with the bias due to the elastic member 42 via the pressers 44 of the attachment piece 36 while moving substantially in the vertical direction in relation to the planar portion of the reference surface R to a position in correspondence to a height of the slope portion 14b against the bias of the elastic member 42.

While the fastener installing device 10 further enters the curved portions 14c of the opposite side holding parts 14 from this state to press the three fastener members 12 into these curved portions 14c and the linear portion 14a of the central holding part 14 at the same time (the lower shifting area in Fig. 7), the operator linearly moves the fastener installing device 10 in the arrowed direction A along the linear portion 14a as before. This moving operation is linearly guided by the mutual contact between the pressers 44, the guide members 46 of the first attaching section 26 and the opposite side walls 110 of the corresponding holding part 14 in the same manner as in the upper and intermediate shifting areas described above.

In the meanwhile, the first attaching section 26 of the fastener installing device 10 returns to the state shown in Fig. 8(a) and loads the base 16 of the corresponding fastener member 12 with the bias due to the elastic member 42 via the pressers 44 of the attachment piece 36. Also, as shown in Fig. 9(b), both the attachment pieces 48 in the second attaching sections 28 move on the guide rail 56 in the direction mutually away from each other (substantially the horizontal direction in relation to the planar portion of the reference surface R) by the guiding action of the pressers 70 (and the auxiliary guide action of the guide members 72), and rotate about the shaft 52 (on an axis extending substantially in the vertical direction in relation to the planar portion of the reference surface R). While maintaining this state, both the second attaching sections 28 load the bases 16 of the corresponding fastener members 12 with the pressure applied by the operator onto the body 24 via the pressers 70 of the attachment pieces 48.

The fastener member 12 installed in the respective holding part 14 by means of the fastener installing device 10 in such a manner is located at a proper position wherein, since the base 16 is pressed into the receptive groove 22 under the sufficient pressure, opposite edges of the base 16 extending in the longitudinal direction are brought into close contact with the inner surfaces 110a of the pair of side walls 110 of the holding part 14 and the major surface 18 of the base 16 in the box-shaped section 80' provided at each of the opposite longitudinal ends is brought into close contact with the top surface of the sealed part 114 provided at each of the opposite longitudinal ends of the holding part 14, as shown in Fig. 6. At this proper position, the plurality of engaging elements 20 of the fastener member 12 are accommodated in the recess 118 of the receptive groove 22 of the holding part 14. Accordingly, during the molding of the main body, molten resinous material thereof (for example, expandable liquid resin such as polyurethane) is assuredly prevented from entering the recess 118.

Since a plurality of fastener members 12 can be installed in a plurality of holding parts 14 substantially at the same time in such a manner according to the fastener installing device 10, it is possible to reduce the operation time required for the installation of the fastener members 12, resulting in the enhancement of productivity of the molded main body with fasteners. Also, it is possible to significantly mitigate the fatigue of the operator because the base 16 and the group of engaging elements 20 of the fastener member 12 are assuredly pushed into the receptive groove 22 of the respective holding part 14 solely by linearly moving the fastener installing device 10 in one direction while smoothly conforming the respective attaching sections 26, 28 with the bending profile of the corresponding holding parts 14. In addition, since a sufficient pressure is easily applied to the base 16 of the respective fastener member 12 in the meanwhile, it is possible to quickly and properly install the fastener member 12 in the respective holding part 14 with no need of the operational skill.

The above-mentioned structure of the first and second attaching sections 26, 28 of the fastener installing device 10 (particularly, the mechanism for moving the same) is especially effective for three holding parts 14 having the arrangement and the curved profile shown in Fig. 7. That is, since the central holding part 14 does not have a curved portion 14c but has a slope portion 14b, the corresponding first attaching section 26 is solely movable substantially in the vertical direction in relation to the lower

surface 30b of the support frame 30; on the other hand, since each of the opposite side holding parts 14 does not have a slope portion 14b but has a curved portion 14c, the corresponding second attaching section 28 is not only movable substantially in the horizontal direction in relation to the lower surface 30b of the support frame 30 but also rotatable about an axis extending substantially in the vertical direction. In addition, the one-directional linear manipulation during the installing operation is achieved by the guiding action of the central holding part 14 and the first attaching part 26 while being in mutual contact with each other, and in correspondence to the diverging curved portions 14c of the opposite side holding parts 14, the initial positions of both the attaching sections 28 are determined closer to the center of the body 24.

The fastener installing device according to the present invention, however, should not be limited to such an arrangement, but the number and the moving mechanism of the holding parts may variously change in accordance with the number, arrangement and curved profile of the holding part on which the installation is carried out. For example, in the above-mentioned three holding parts 14, if the curved portions 14c of the opposite side two holding parts 14 converges to be closer to each other, the initial positions of both the second attaching sections 28 may be determined closer to opposite ends of the body 24, respectively. Alternatively, if each of the three holding parts 14 has a linear portion 14a, a slope portion 14b and a curved portion 14c at proper positions, all the attaching sections 26, 28 may have the vertical displacement mechanism, the horizontal displacement mechanism and the rotational mechanism described before. Note that, in this case, to achieve the one-directional linear manipulation in the installing operation, an additional guide mechanism is preferably provided for linearly guiding the body of the fastener installing device in one direction along these holding part.

Fig. 10 schematically illustrates a fastener installing device 120 provided with such an additional guide mechanism according to another embodiment of the present invention. The fastener installing device 120 has a body 122 operable in a hand-held manner and a plurality of attaching sections 124 provided in the body 122 to be engageable with a plurality of fastener members 12, respectively, and operative to press a base and a group of engaging elements of the respective fastener member 12 into a receptive groove of the corresponding holding part 14. During the movement of the

body 122 along a plurality of holding parts 14, Each of the attaching sections 124 is movable substantially in the vertical and horizontal directions in relation to a lower surface 122a of the body 122 and rotatable about an axis extending substantially in the vertical direction. Also, in the respective attaching section 124, an elastic member 126 is provided to generate a bias for pushing the base and the group of engaging elements of the fastener member 12 into the receptive groove of the corresponding holding part 14.

At left and right ends of the body 122, linear guides 128 is fixedly provided, respectively. The linear guides 128 engage in a slidable manner, respectively, with a pair of linearly extending guide rails 130 fixedly provided on the reference surface R on which a plurality of holding parts 14 are formed. According to the fastener installing device 120 of such a structure, even though the plurality of holding parts 14 have various three-dimensionally curved profiles, the operator can assuredly push the base and the group of engaging elements of the fastener member 12 into the receptive groove of the corresponding holding part 14 only by linearly moving the fastener installing device 120 in one direction under the linearly movable engagement between the linear guide 128 and the guide rail 130 so that the respective attaching section 124 smoothly conforms with the curved profile of the corresponding holding part 14.

Although the present invention have been described above with reference to the preferred embodiments of the fastener installing device, the present invention should not be limited to the illustrated aspects but includes various modifications and changes. For example, in the plurality of attaching sections, one carrying out the operation on the holding part solely formed of a linear portion can be fixedly secured on the body. Also, Shapes of the support frame and the grip of the body of the fastener installing device or shapes of the attachment piece of the attaching section may be other than those illustrated.

Fig. 11 shows a fastener member 140 to which the fastener installing device according to the present invention is conveniently applicable. The fastener member 140 is provided with a strip-shaped base 142 and a plurality of engaging elements 144 having substantially the same construction as in the base 16 and the engaging elements 20 of the above-mentioned fastener member 12. Further, the fastener member 140 is provided at one longitudinal end of the base 142 with a wall-shape protrusion 148

projecting uprightly from a major surface 146 of the base 142 substantially in the same direction as the group of engaging elements 144.

When the fastener member 140 is installed in the holding part 14 by using the above-mentioned fastener installing device 10, one longitudinal end of the base 142 of the fastener member 140 is positioned substantially at one longitudinal end of the holding part 14 as a preparatory operation and thereafter, an end region of the base 142 and the group of engaging elements 144 corresponding thereto are pushed into an end region of the receptive groove 22 to temporarily fix the same. Then, the protrusion 148 provided at the longitudinal end of the base 142 of the fastener member 140 engages with one longitudinal end surface 119 (Fig. 3) of the holding part 14. Thereafter, while the fastener installing device 10 is shifted along the holding part 14, the protrusion 148 maintains the engaging state. Thus, while the installation of the fastener member 140 has been completed, the fastener member 140 is assuredly prevented from shifting in the longitudinal direction within the receptive groove 22 of the holding part 14. Thus, according to the fastener member 140, it is possible to further facilitate the installation workability of the fastener installing device 10.

Fig. 12 shows a fastener member 150 to which the fastener installing device according to the present invention is conveniently applicable. The fastener member 150 is provided with a strip-shaped base 152 and a plurality of engaging elements 154 having substantially the same construction as in the base 16 and the engaging elements 20 of the above-mentioned fastener member 12. Further, the fastener member 150 is provided at one longitudinal end of the base 152 with an extension 158 extending from a back surface 156 of the base 152 in a hooked and bent manner.

When the fastener member 150 is installed in the holding part 14 by using the above-mentioned fastener installing device 10, the extension 158 provided at one longitudinal end of the base 152 of the fastener member 150 is hooked to the attachment piece 36, 48 of the respective attaching section 26, 28 to temporarily fix the same. Thus, the positioning of one longitudinal end of the base 152 of the fastener member 150 to one longitudinal end of the holding part 14 as well as the temporary attachment of the end region of the base 142 and the group of engaging elements 144 corresponding thereto to the receptive groove 22 can be easily carried out at the same time on the plurality of fastener members 150 temporarily attached to the respective

attaching sections 26, 28 of the fastener installing device 10, whereby it is possible to further reduce the time required for the installation carried out by the fastener installing device 10. In this case, as shown in Fig. 13 on the attaching section 26, the attachment piece 36 is preferably has a slit 160 capable of receiving a distal end portion of the extension 158 of the fastener member 150.

Note that it is possible to provide a fastener member having both of the protrusion 148 and the extension 158 described above. Such a fastener member is capable of significantly facilitating the installation workability of the fastener installing device according to the present invention.

As apparent from the above description, according to the present invention, in a fastener installing device used for installing in advance a strip-shaped fastener member, which is to be mounted to a main body molded by an insert molding process, in a rail-shaped holding part laid within a mold cavity for the molded main body, even though a plurality of fastener members must be mounted to the molded main body, it is possible to reduce the time required for the installation of the fastener members and facilitate the productivity of the molded main body with fasteners. Also, it is possible to quickly and accurately install the fastener member even in the holding part having various three-dimensionally curved profiles with no need of operational skill while mitigating the fatigue of the operator.

Further, according to the present invention, a fastener member is provided, which is capable of further facilitating the installation workability of such a fastener installing device.